299-E33-70 (A6878)

Log Data Report
(REVISED)

Borehole Information:

Borehole:	299-E33-70 (A6878)		Site:	216-B-8 Crib	
Coordinates (WA State Plane)		GWL[1] (ft):	n/a[2]	GWL Date:	n/a
North (m)	East (m)	Drill Date	TOC[3] Elevation (ft)	Total Depth (ft)	Type
573775	137462	Dec. 1947	643.81	150	unknown

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel Welded	2.2	8 5/8	8	0.3125	0	150

Borehole Notes:

The borehole was swabbed before collecting data, and no water or contamination was detected inside the casing. The logging engineer measured the pipe stickup at the borehole using a steel tape. Calipers were used to measure casing outside diameter and thickness only; the inside diameter is calculated. Stickup was measured between survey points marked on the casing. The drilling date and casing depth are derived from *Hanford Wells* (Chamness and Merz 1993). Coordinates and TOC elevation are derived from HWIS[4].

Logging Equipment Information:

Logging System:	Gamma 2B		Type: SGLS (35%)
Calibration Date:	09/00	Calibration Reference:	GJO-2001-245-TAR
		Logging Procedure:	MAC-HGLP 1.6.5
Logging System:	Gamma 1C		Type: HRLS
Calibration Date:	02/02	Calibration Reference:	GJO-2002-309-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4 Repeat		
Date	09/13/01	09/13/01	09/13/01	09/17/01		
Logging Engineer	Spatz	Spatz	Spatz	Spatz		
Start Depth (ft)	2.5	30.5	60.0	151.0		
Finish Depth (ft)	31.5	61.0	92.5	91.5		
Count Time (sec)	100	30	100	100		
Live/Real	R	R	R	R		
Shield (Y/N)	N/A[3]	N/A	N/A	N/A		
MSA Interval (ft)	0.5	0.5	0.5	0.5		
ft/min	N/A	N/A	N/A	N/A		
Pre-Verification	B0051CAB	B0051CAB	B0051CAB	B0052CAB		
Start File	B0051000	B0051059	B0051121	B0052000		
Finish File	B0051058	B0051120	B0051186	B0052119		

Log Run	1	2	3	4 Repeat		
Post-Verification	B0051CAA	B0051CAA	B0051CAA	B0053CAA		
Depth Return Error (in.)	N/A	N/A	0	1.0		
Comments	See fine-gain adjustment statement below.	Logging parameter change; depth interval exceeds 50% dead time.	No fine-gain adjustments made during this log run.	Repeat section. No fine-gain adjustments made during this log run.		

High Rate Logging System (HRLS) Log Run Information:

Log Run	1	2	3			
Date	03/07/02	03/12/02	03/13/02			
Logging Engineer	Kos	Kos	Kos			
Start Depth (ft)	29.0	41.0	63.0			
Finish Depth (ft)	42.0	64.0	72.0			
Count Time (sec)	300	300	300			
Live/Real	R	R	R			
Shield (Y/N)	N	N	N			
MSA Interval (ft)	0.5	0.5	0.5			
ft/min	N/A	N/A	N/A			
Pre-Verification	D0022CAB	D0024CAB	D0025CAB			
Start File	D0022000	D0024000	D0025000			
Finish File	D0022026	D0024046	D0025018			
Post-Verification	D0022CAA	D0024CAA	D0026CAA			
Depth Return Error (in.)	- 0.5	- 0.25	- 0.75			
Comments	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.			

Logging Operation Notes:

SGLS and HRLS logging were performed in this borehole during September 2001 and March 2002, respectively. The reference depth for logging measurements is the top of casing. The HRLS was utilized to perform logging in high gamma flux zones, generally where the SGLS dead time exceeded 40 percent. A repeat section was collected in this borehole during SGLS log run 4.

Analysis Notes:

Analyst:	SS/PH	Date:	03/26/02	Reference:	MAC-VZCP 1.7.9, Rev. 2

This Log Data Report is a revision of the report originally issued 10/04/01. This revision includes high rate data analysis results that were not previously reported and replaces the original Log Data Report.

Pre-run and post-run verification spectra for the SGLS were evaluated. All of the spectra were within the control limits. The post-survey verification (file B0053CAA) was outside of the warning limits. The photopeak counts per second for the 1461-keV peak and the 609-keV peak were below the lower warning limits for this post-run verification spectrum. The photopeak counts per second for the 2615-keV peak was below the lower warning limits for the post-run verification spectrum file B0051CAA. Evaluation of the spectra indicated that the tool is functioning properly, and the spectra are provisionally accepted. HRLS verifications passed the acceptance criteria.

A casing correction for 0.3125-in.-thick casing was applied to the log data.

Each spectrum collected during a log run was processed in batch mode using APTEC Supervisor to identify individual energy peaks and determine count rates. Concentrations were calculated in EXCEL, using an efficiency function and corrections for casing and dead time determined in calibrations. EXCEL templates named G2bSep01.xls and G1cFeb02.xls were used to process the SGLS and HRLS data, respectively. Dead time corrections are applied to log data, including the total gamma data, where the dead time is in excess of 10.5 percent. In zones of high dead time (>40 %), gross count rates and radionuclide concentrations become increasingly less reliable, and may be significantly higher that the reported values. The HRLS is used in zones of high SGLS dead times to quantify the ^{137}Cs concentrations. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations rather than the ^{214}Bi peak at 609 keV. The 609-keV energy peak cannot be distinguished as a result of interference from the ^{137}Cs peak at 662 keV in higher concentration zones.

Log Plot Notes:

Separate log plots are provided for the man-made radionuclide (^{137}Cs), naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th [KUT]), a combination of man-made, KUT, total gamma and dead time, and a plot of total gamma and dead time. Data collected with the HRLS are substituted for SGLS data where appropriate to provide a continuous record of the most accurate ^{137}Cs concentrations.

For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction.

Results and Interpretations:

The man-made radionuclide detected in this borehole was ^{137}Cs. A zone of ^{137}Cs contamination was detected near the ground surface (log depth 3.0 through 7.5 ft) with activities ranging from 0.3 to 95.3 pCi/g. ^{137}Cs also was detected between 28 and 120.5 ft. The highest concentrations were measured between 31 and 71 ft, where high SGLS dead time occurred. HRLS data are substituted in this interval. The maximum concentration measured by the HRLS was about 48,000 pCi/g at 32.5 ft in depth.

Above the zone of intense gamma-ray activity, apparent ^{40}K activities are about 13 pCi/g. Within the zones of intense gamma-ray activity, apparent ^{40}K activities are about 18 pCi/g. The relatively high concentrations of ^{137}Cs below about 30 ft may correspond with the increase in ^{40}K activities and the transition from the coarse-grained sediments of the Hanford H1 to the finer grained sediments of the Hanford H2.

References:

Chamness, M.A. and J.K. Merz, 1993. *Hanford Wells*, PNL-8800, prepared by Pacific Northwest Laboratory for the U.S. Department of Energy.

[1] GWL – groundwater level
[2] n/a – not applicable
[3] TOC – top of casing
[4] HWIS – Hanford Well Information System

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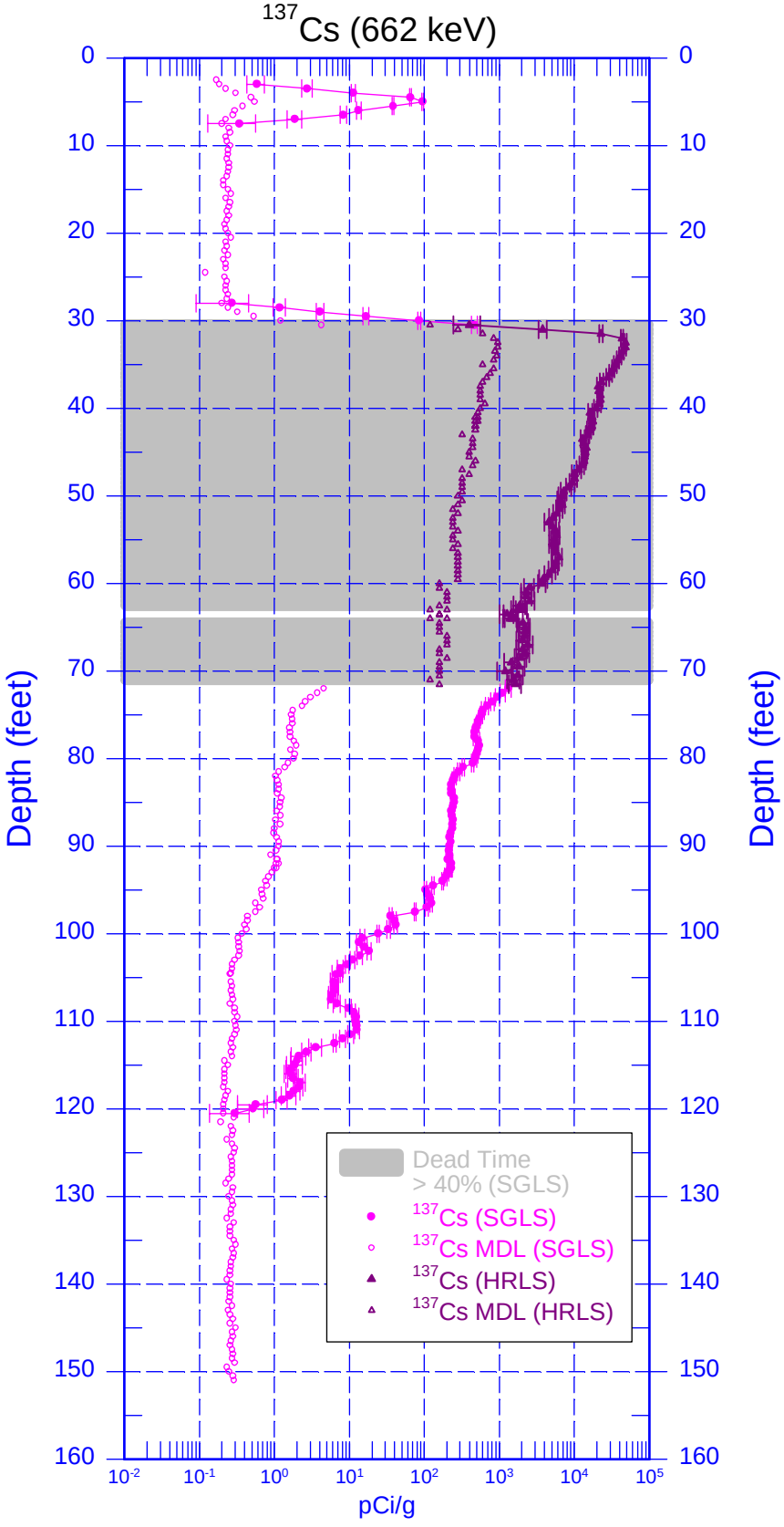
Man-Made Radionuclide



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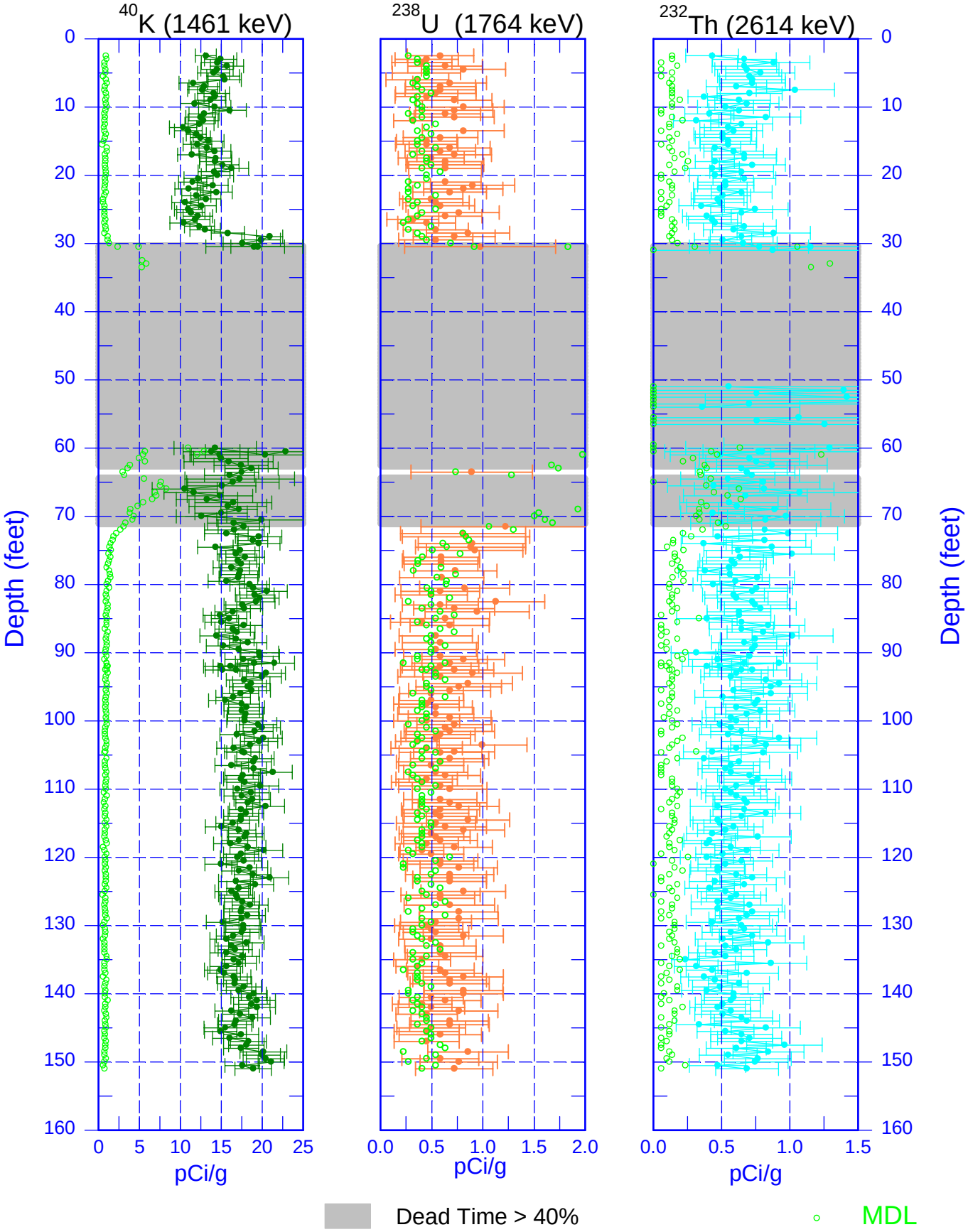
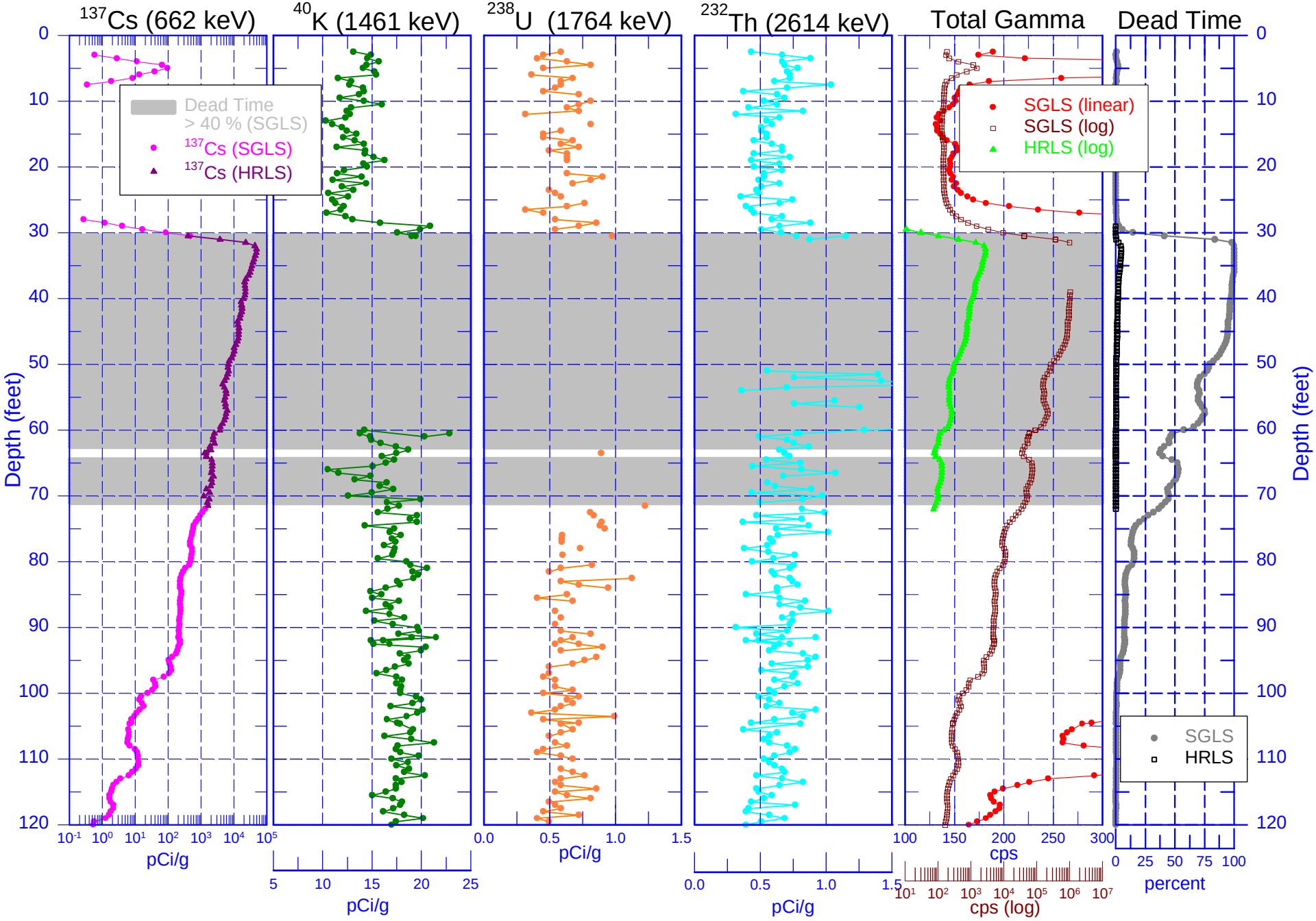
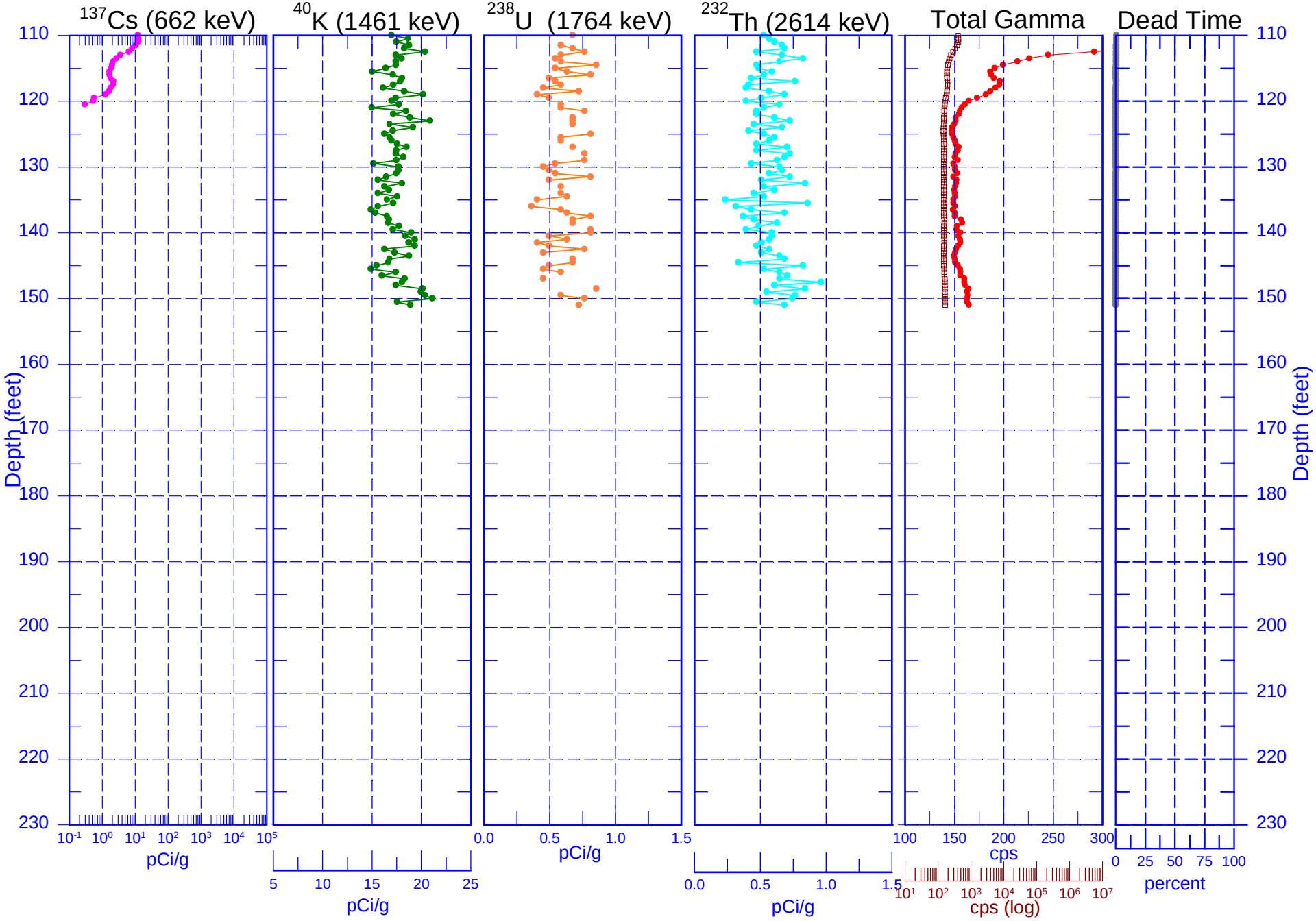
Natural Gamma Logs



299-E33-70 (A6878) Combination Plot



299-E33-70 (A6878) Combination Plot



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Total Gamma & Dead Time